

# REMARKS

Claims 1-80 are pending; and no claims stand allowed. With this amendment, claims 1 and 30 are amended.

## Rejection of independent claim 1

Independent claim 1 was rejected in the Office Action under 102(b) as being anticipated by Tai (US 6,436,229). The undersigned respectfully submits that this rejection was in error. However, the undersigned amended claim 1 to place claim 1 a better form for examination.

Specifically, claim 1 now is directed to a method comprising a process for processing a microstructure, said process comprising: loading the microstructure into an etch chamber of an etch system, wherein the microstructure comprises a sacrificial material and one or more structural materials; providing a spontaneous vapor phase etchant recipe to the etch system; and providing an additional amount of the spontaneous vapor phase etchant recipe to the etch system at a time that is determined based on a measurement of an amount of a chemical species in the process.

The undersigned respectfully submits that Tai does not teach or suggest introducing first and second amounts of spontaneous vapor phase etchant recipe into the chamber, much less introducing the second amount “the additional amount” based on a measurement of an amount of a chemical species in the process.

In the “Response to Argument” section of the Office Action, the Examiner stated that, col 4, lines 57-60 of Tai, “reads on measuring an amount of a chemical species and providing an additional amount of etchant recipe based on the measured chemical species since the chemical species is defined as an etchant in the instant claimed invention” (emphasis added). First, the undersigned respectfully submits that, the chemical species is not “defined as an etchant in the instant claimed invention” but instead, the chemical species may be an etchant, but can also be other chemicals such as a chemical species that is a product of the etching reaction. Secondly, regardless of what is determined to be the claimed chemical species in the Tai reference, Tai nowhere teaches or suggests the step of providing an additional amount of the spontaneous vapor phase etchant recipe to the etch system at a time that is determined based on a measurement of an amount of a chemical species in the process. This is in essence a “feed back loop”, where an amount of a chemical species is determined, and based on the amount of the chemical species, additional etchant recipe is provided to the etch system. Tai has no such measurement, nor providing of etchant in response to the measurement. Because Tai fails in teaching or suggesting all features of claim 1, claim 1, as well as claims 2-8 that are dependent from claim 1, is patentable over Tai. Reconsideration and withdrawal of the rejection of the claims under section 102(b) in view of Tai, are respectfully

requested.

Rejection of independent claim 63

Independent claim 63 was rejected in the Office Action under 103(a) as being obvious over Tai in view of Winningham (US 6,518,194). This rejection is respectfully traversed.

Claim 63 expressly recites, among other features, the step of etching the second microstructure in the second etching process using the etchant recipe based on the collected data of the parameter in the first etching process. Tai does not disclose or suggest this feature, as indicated by the Examiner. The Examiner states that the deficiency in Tai is remedied by Winningham (example 8). The undersigned respectfully submits that there is no motivation to combine Tai and Winningham. Tai is related to gas phase silicon etching with  $\text{BF}_3$ , while the example 8 of Winningham is related to etching Cr coated bionanomasks applied directly to a silicon substrate using  $\text{H}_2$  and  $\text{SF}_6$  as etchant – two completely different processes and products.

Even forced to combine the two references, Winningham does not remedy the deficiency of Tai. More particularly, claim 63 brings out an embodiment of applicant's – namely etching with a spontaneous vapor phase etchant, and collecting data where the data is a detected chemical species during the etch. Neither Tai nor Winningham teach or suggest these further features as set forth in claim 63. Because the combination of Tai and Winningham does not disclose or suggest all features of claim 63, claim 63, as well as claims 64 and 66-71 that are dependent from claim 63, is patentable over Tai and Winningham. Reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of independent claim 72

As for the Examiner's rejection of claim 72 under 102(b) over Tai, this rejection is also respectfully traversed.

Claim 72 expressly recites, among other features, the step of collecting a plurality of data of a parameter that characterizes an etching process using an etchant recipe that comprises a spontaneous vapor phase etchant comprising  $\text{XeF}_2$ ; storing the collected data; and etching a microstructure using the etchant recipe based on the collected data of the parameter. In contrast, lines 30-38 at column 5 of Tai recite the “... characteristics of  $\text{BrF}_3$  gas ...” and “In order to exploit these characteristics (of the  $\text{BrF}_3$  gas), etching processes are preferably conducted using pulse  $\text{BrF}_3$  flow etching.” (with the language in parentheses added by the undersigned). Because Tai does not disclose or suggest all features recited in claim 72, claim 72, as well as claims 73-80, is patentable over Tai. Reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of independent claim 53

With respect to the Examiner's rejection of claim 53 under 102(b) over Zhang, the undersigned respectfully submits that the rejection was in error.

Claim 53 expressly recites, among other features, the step of providing the etchant recipe to the etch chamber over time, wherein the amount of the etchant is varied when the change of the measured parameter is beyond the predetermined value. Instead, table 2 of Zhang details an etching cycle, where a variety of gaseous components are passed through the etching chamber for certain time periods – only one of which is an “etchant recipe”. Specifically, the etching cycle of Table 2 in Zhang includes a) an initial purge with N<sub>2</sub>, b) a pretreatment step with N<sub>2</sub> and vapor H<sub>2</sub>O, c) an etch step with N<sub>2</sub>, vapor H<sub>2</sub>O and vapor HF, d) removing residual HF with vapor H<sub>2</sub>O, followed by a “high purge” with N<sub>2</sub>. In Zhang, there is only a single etch step (using N<sub>2</sub>, vapor H<sub>2</sub>O and HF) – there is no varying of the amount of Zhang etchant recipe over time. The statements in column 5, lines 30 to 50 in Zhang are directed to how *two different* etch processes would happen – not a changing of the amount of the etch recipe for an etch of the same sample. The statement “the speed of this ‘etch’ operation is enhanced by adding H<sub>2</sub>O to the vapor HF” is an explanation of why H<sub>2</sub>O is part of the etchant recipe. Whereas the statement “eliminating vapor H<sub>2</sub>O from this process reduces the etching rate to about 60 angstroms per 10 seconds” is specific data/evidence of why, if H<sub>2</sub>O had not been included, the etch rate would have been much slower. Zhang does not etch any sample with two different etch recipes – one with and one without H<sub>2</sub>O. In addition, Zhang does not teach or suggest varying an amount of etchant in an etching method based on a change of a measured parameter being beyond a predetermined value. It is hoped that the Examiner will reconsider the relevancy of the Zhang reference, as it appears to the undersigned that this reference is deficient in a number of ways, as outlined above.

Because Zhang fails in disclosing or suggesting all features of claim 53, claim 53, as well as claims 54-62 that are dependent from claim 53, is patentable over Zhang. Reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of independent claim 30

Independent claim 30 was rejected under 102(b) over Zhang (6,162,585). In particular, the Examiner stated that the feature of “the amount of the etchant recipe per time unit varies” recited in claim 30 is disclosed in table 2 of Zhang. It is respectfully submitted that the Examiner's above statement was in error; and the rejection is respectfully traversed. However, to help further the examination of claim 30, the undersigned amends claim 30 so as to expressly recites, among other features, that the recipe

comprises an interhalogen or noble gas halide.

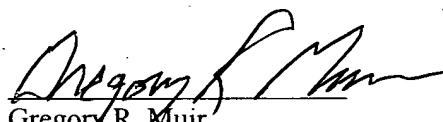
As discussed above with reference to the Examiner's rejection to claim 53, table 2 of Zhang details an etching cycle, where a variety of gaseous components are passed through the etching chamber for certain time periods – only one of which is an “etchant recipe”. Table 2 does not disclose or suggest the feature that the amount of etchant recipe per unit time varies for etching the same microstructure. Moreover, Zhang does not teach or suggest the interhalogen or noble gas halide as the etchant.

Because Zhang fails in disclosing or suggesting all features of claim 30, claim 30, as well as claims 31-52 that are dependent from claim 30, is patentable over Zhang. Reconsideration and withdrawal of the rejection are respectfully requested.

It is believed that this application is in condition for allowance. Favorable consideration and prompt allowance are respectfully requested. In the event any fees are required in connection with this paper, please charge our Deposit Account No. 501516.

Respectfully submitted,

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